THE ROENTGENOLOGIC MANIFESTATIONS AND DIFFERENTIAL DIAGNOSIS OF CARCINOMA OF THE COLON*

B. R. KIRKLIN
AND
HARRY M. WEBER
Rochester, Minnesota

It is not an exaggeration to say that the roentgen ray has contributed as much to the precise and accurate diagnosis of carcinoma of the colon as it has to the diagnosis of carcinoma of the stomach. The roentgenologic signs of carcinoma of the colon, like those of carcinoma of the stomach, are distinctive and can be elicited not only at the stage when the disease is clinically apparent on account of the ulceration or obstruction which it has produced, but when subjective and objective evidence from other sources is entirely lacking or very indefinite.

In no division of gastro-enterologic roentgenology does the roentgen ray compete with the microscope in making histologic diagnoses. The roentgenologist, however, does not hesitate to exercise his prerogative as a physician to reinforce the visual characteristics of a lesion furnished by his special method of observation with such other features as topical manipulation of the diseased segment might supply. Such are the units of which the roentgenologist's conception of the gross appearance of a lesion is composed. His diagnostic efficiency depends in a large measure on his familiarity with macroscopic pathology, and on the facility with which he is able to correlate the gross pathologic picture with the roentgenologic picture. It is not an idle boast to affirm that the roentgen ray can be made to exhibit a favorable showing in competition with macroscopic examination in the diagnosis of carcinoma of the colon, and in distinguishing it from other lesions of the colon.

---

*Delivered before The New York Academy of Medicine, February 4, 1932. This article will appear also in the *New York State Journal of Medicine.*

PATHOLOGY

Carcinoma is by far the most commonly encountered malignant lesion of the colon. Sarcoma is seen with extreme rarity. The gross features of a nonepithelial malignant lesion usually bespeak its malignant nature, but a certain diagnosis is possible only after microscopic examination of the tissue.

Rankin classifies carcinomas of the colon morphologically into the following types:

Scirrhous or fibrocarcinoma.—In these tumors there are relatively few carcinoma cells. Fibrous tissue, however, may be so abundant that it is difficult to recognize epithelial cells. Early in its development the tumor consists merely of a small, flat, indurated area in the wall of the bowel. Gradually the intestinal tube is encircled in annular fashion. Stenosis develops with cicatricial contraction of the fibrous tissue. The names "annular" or "napkin-ring" carcinoma are descriptive of its macroscopic appearance. Ulceration is not a prominent feature, hence early in the clinical course blood or mucus is not noted in the stool, and the disease becomes clinically apparent only when obstruction begins to be manifest. As a rule the tumor itself is too small to be palpable through the abdominal wall. The mass sometimes discovered in association with it is usually a collection of scybalous fecal material proximal to the constriction.

Medullary or polypoid carcinoma.—It is important to keep in mind that polypoid tumors, which macroscopically have all the characteristics which we have learned to associate with benign lesions, are not infrequently found on microscopic examination to be malignant. In fact, it is now quite generally believed that medullary or polypoid carcinomas have their beginnings in lesions indistinguishable grossly from the simple and so-called benign polyp. It is therefore to be expected that all stages in the development of a pedunculated or broad-based polypoid tumor to the frank medullary carcinoma with extensive exposed

surfaces will be encountered. Medullary carcinomas are characterized grossly by large, soft, lobulated or cauliflower-like masses projecting into the lumen from the mucosal surface. The margins are irregular, overhanging, elevated; the floor of ulcerated areas is ragged and covered with exudate. Sometimes the intestinal wall does not seem to have been extensively invaded. More commonly, however, mural infiltration is marked and the lesion has the indurated consistence characteristic of malignancy. Necrosis and sloughing of the peripheral proliferative portions of an originally pedunculated polyp result in a flat, saucer-shaped lesion.

Gelatinous (mucoid) carcinoma.—Morphologically, this type of carcinoma of the colon might be looked on as holding a middle ground between the medullary and scirrhous forms. It becomes a circular lesion, enveloping the bowel in annular fashion, but is a much more extensive lesion than the true fibrocarcinoma. In the latter the constricting feature is apparent from both the luminal and serosal aspects. In the former, however, the wall is markedly thickened, heaping up of the malignant tissue having progressed both into and away from the lumen. The luminal aspect of fibrocarcinoma presents a short stricture with little, if any, ulceration. With the colloid type of lesion, however, the channel through the tumor is relatively long, and its luminal surface is denuded and irregular in its course. The tumor is firm and when in a situation accessible to manipulation, may be discovered clinically by the hard mass it presents.

Methods of Investigation

The opaque meal.—The earliest examinations of the large intestine were carried on with the opaque meal. It is now generally agreed, however, that this method is incapable of delivering adequate information regarding organic lesions, although it still has applications in special instances. Its property of becoming dispersed in scattered masses or accumulated in large lumps in separate segments, prevents a satisfactory estimate of the entire colon. Repeated roent-

genoscopic examinations are always required. Further, in the presence of an obstructing lesion, the opaque meal is liable to become impacted above the stenosis. It may thus be responsible for much distress to the patient, and seriously affect the prognosis by becoming the immediate cause of acute intestinal obstruction.

The opaque enema.—Almost all organic diseases of the colon produce deformity in the contours of the lumen of the affected segment. This is particularly true of carcinoma. It follows that the choice of an investigative procedure will devolve on the method which serves best to demonstrate the deformity. The opaque enema is the procedure of maximal efficiency for this purpose.

It is hardly possible to outline the technic of administering the opaque enema without placing emphasis on the necessity of clearing the colon of fecal remnants, gas and fluid before investigation is attempted. This cannot be accomplished without purgation and cleansing enemas. Saline cathartics are ill-advised as purgative agents because they produce their effect by osmotically drawing fluid into the intestinal lumen to the point of maximal distensibility. Evacuation after saline purgation is frequently incomplete and considerable time is usually required for the colon to assume a state of collapse sufficient for satisfactory observation of the opaque enema. On the other hand, purgatives the action of which depends on their property of activating the bowel by severe irritation are likewise undesirable because they are not uniformly efficient, and because of their tendency to leave the colon in such a prolonged state of irritability that retention of the enema becomes extremely difficult or impossible. Castor oil, of all the purgative agents active enough to produce adequate evacuation, is in fact a milder irritant than many others, and we consider it to be the most uniformly efficient purgative agent available for our purposes. The patient to be examined abstains from his evening meal and takes 2 ounces (60 c.c.) of castor oil. The following morning, before the examination, the distal portion of the colon is cleansed with a few normal saline enemas. It is assumed

that the castor oil will have achieved this result in the proximal segments. This procedure usually effects a satisfactory preparation, and the routine is broken only for patients with very severe diarrhea, for those who have a tendency toward severe intestinal hemorrhages, and occasionally for patients with acute or subacute obstruction.

Occasionally a patient experiences undue difficulty in retaining the enema, and sometimes when there is reason to believe that considerable intestinal spasm accompanies the suspected lesion, the administration of an antispasmodic drug often proves helpful. It seems hardly necessary to point out that the drug must be administered to full physiologic effect. Inhalation of amyl nitrite at the time of examination sometimes answers the purpose, but atropine in the form of tincture of belladonna is more efficient and reliable. Sixty drops of the tincture, divided into three equal doses, two of which are taken at an interval of two hours the evening before the examination, and the remaining dose within an hour before the examination, is a dependable form of administration.

Some attention should be devoted to the preparation of the enema itself. Since the roentgenoscopic observation of the opaque enema is the keystone procedure in the roentgenologic examination, the enema must contain a concentration of the basic opaque substance sufficiently high to yield maximal contrast. The opaque material in the enema should be minutely divided, uniformly suspended, and the suspension should be well sustained. Simple suspension in water by agitation is inadequate on account of the rapidity with which the salt is precipitated from such a mixture. Several commercial preparations of barium sulphate are available which are satisfactory in this respect, or a suspending agent, such as gum acacia, may be added to the mixture when it is prepared in the laboratory. The consistence of the suspension should approximate that of heavy cream. It is most important that the temperature of the enema be kept at or slightly above the temperature of the body, because the colon reacts violently at times to the direct application of cold.

With the patient in the recumbent position the enema is administered slowly and steadily, under constant roentgenoscopic observation from the time it enters the rectum until the cecum and terminal coils of ileum are visualized. This is necessary in order to detect abnormalities which may later be hidden by an overlying loop of normal bowel. As the examination progresses the patient is rotated from side to side to obtain views at different angles. These maneuvers, coupled with careful palpatory manipulation, are essential parts of the examination.

Although the roentgenoscopic observation of the opaque enema is the basic and cardinal roentgenologic procedure in the investigation of the colon, it must not be inferred that roentgenography is unnecessary or superfluous. A well executed roentgenogram will often provide invaluable supplementary information which was not so clearly available at the roentgenoscopic examination. On the other hand, the practice of administering the opaque enema, and confining the investigation of the colon to the examination of one or two roentgenograms in different positions is so inadequate that it is mentioned here only in condemnation. Roentgenograms usually are made with the patient in the prone position. It will often be found necessary, however, to place the patient in an unusual position, or to use some form of compression so that the lesion can be projected on the film to best advantage (fig. 1).

Demonstration of mucosal relief.—This relatively new and very interesting method of investigation, sponsored especially by Knothe, Berg, Forssell and others, should be given a place among the valuable diagnostic procedures. Although workers in this field generally advise against the use of purgative agents when this method is employed, the examination of the mucosal relief can be carried on after the evacuation of the enema administered as has been outlined. Essentially the method consists of a study of the relief patterns assumed by the mucosa of the intestine covered with a thin coat of opaque material. The lumen of the colon must be thoroughly cleansed beforehand. The opaque enema is then administered under roentgenoscopic

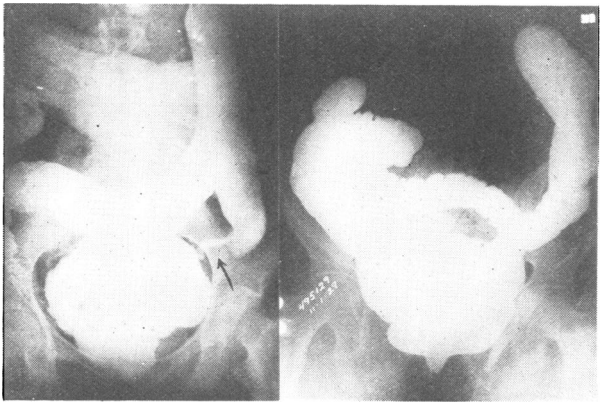

Fig. 1
Carcinoma (note arrow) involving the descending colon near its juncture with the sigmoid. At the left the lesion is exposed by a slight rotation of the patient to the right and by the overlying loop of transverse colon being separated by the hand of the patient. At the right is the roentgenogram made in the routine manner with the patient in the prone position. A lesion cannot be seen.

control after which the opaque material is evacuated. The mucosal relief is inspected both on the screen and on films. Experience at The Mayo Clinic with this procedure is too limited to permit a reliable opinion about its value. Correct interpretations of these not uncomplicated mucosal states will be born only of judgment acquired by long experience and carefully controlled observations.

The use of gases as contrast substances.—Long before the introduction of inert salts of heavy metals, investigations of the alimentary tract, especially of the stomach and colon, were carried on with the use of gases, chiefly air, as contrast substances. However, they never were universally employed. In special instances, when for some reason the use of opaque salts might be inadvisable or contraindicated, the inert gases may serve a useful purpose. It is possible to obtain a satisfactory outline of the colon by insufflation, but the picture lacks the distinctness necessary for accurate diagnostic work.

Combined methods of examination.—The first method, a combination of the opaque meal and opaque enema, hard-

ly merits the name of a special procedure. It is applied only when the opaque meal has met with an obstruction and the opaque enema is used to determine the distal limits of the stenosis. The warning to exert every effort to prevent a large mass of insoluble and inert material from accumulating proximal to an obstruction bears repetition in a criticism of this practice. The danger of impaction and complete intestinal obstruction can scarcely be overemphasized.

The second method is a combination of the opaque meal and insufflation. Laurell, in 1921, described a method of examination of the proximal segments of the colon by administering the opaque meal, waiting until such time as the meal was transported to these segments (four to five hours), and insufflating with air. The same objections apply to this method as apply to the opaque meal when used alone. It has not received wide application, and is not nearly as useful as the following method.

The third method is a combination of the opaque enema and insufflation, or the "double contrast" method. Fischer, in 1923, described a method of investigation which will be found to be of greatest value especially for the demonstration of the nondeforming intraluminal lesion of the colon. Essentially the method is an attempt to coat the luminal surface of the bowel with a thin coat of opaque material, and then to distend the lumen with air. It thus provides what is in reality a transparent medium. Weber suggested several technical modifications which he believes makes the "combined method" more readily interpreted, and emphasized the value of stereoroentgenography with the technic. He pointed to the superiority of this method over all others for the demonstration of polypoid lesions and polyposis of the colon, and exhibited lesions not otherwise demonstrable roentgenographically.

The technic may be carried out to good advantage as follows: Complete removal of all solid, fluid, and gaseous accumulations is an unconditional prerequisite. The opaque enema is then administered under roentgenoscopic

control. The colon is filled as rapidly as is compatible with the comfort of the patient and note is made of any abnormalities apparent. When the cecum has been filled the patient is allowed to evacuate the enema as completely as possible, and it is usually found that about the proper amount of the opaque material remains in the lumen of the bowel. No more than a uniform thin coat is desirable. If large collections of the material are still seen after the attempt at evacuation the rectum can be insufflated with a volume of air sufficient to induce a desire for defecation, whereupon the patient will usually return with as near the ideal distribution and concentration of the opaque material as is possible in his case. A hand blower is used for insufflation. The colon is inflated under roentgenoscopic control, and care is exercised not to over-distend any of the segments. The procedure is facilitated by frequent rotation of the patient on the roentgenoscopic table, and by manipulation of the bowel through the abdominal wall. Insufflation carried out in this way has not been in any way more distressing to the patient than might be expected from the administration of the opaque enema.

As soon as the cecum has been moderately distended the enema tip is removed from the rectum and stereoroentgenograms are made with the patient in the prone position. The fluoroscopic image of the air-filled colon lacks sufficient detail to have diagnostic value. The grid diaphragm is of distinct advantage in educing the fine detail requisite for precise demonstration of the anatomic character of the lesions.

This technic is not recommended as a routine procedure. Compared with the barium enema it is cumbersome, relatively expensive, and may offer little additional information especially in those diseases which produce deformity of the lumen. Its greatest advantages lie in its adaptability for demonstrating otherwise obscure, small, nondeforming lesions, and those which may have been clearly and adequately visualized roentgenoscopically, but which are persistently obscured on the roentgenogram by overlying loops filled with dense opaque material. Unquestionably

the method makes a valuable contribution to increased accuracy and general efficiency of diagnosis of diseases of the colon.

Roentgenologic Signs of Carcinoma in the Colon

Early carcinoma.—Roentgenologic methods are expected to reflect only the gross anatomic characteristics of pathologic processes. From the histologic studies of Schmieden, Schmieden and Westhues, Doering, FitzGibbon and Rankin, and others, it is known that many polypoid lesions of the colon, benign grossly, are in fact carcinomas. Some of them have a tendency to develop malignant characteristics, and it has been shown very definitely that at least some well-defined malignant growths in the colon have their beginnings in these macroscopically benign polypoid lesions. The earliest stage of a malignant process, then, that the roentgenologic method is likely to uncover, is this type of lesion. The term "polypoid lesion" is used advisedly to include any sessile or pedunculated growth projecting into the intestinal lumen, without special reference to the histologic nature of the tissue of which it is composed. It is not possible accurately to determine the cytology or the malignancy of such lesion without microscopic examination, but adenomas, fibromas, myomas and lipomas are the most common types encountered.

The significant roentgenologic features of these lesions are their intraluminal situation and their prevailing failure to produce a roentgenologically demonstrable deformity in the colonic contour. When these tumors are large and situated in segments accessible to palpation the roentgenoscopic examination will give reliable evidence of their presence. Without palpation a momentary split in the column of the enema as it ascends will most frequently be the only indication of the presence of a polypoid lesion. Approximating the walls of the colon, however, will serve to bring out the characteristic smooth, sharp, evenly rounded or ovoid contours of the central defect. The marginal contours of the colon may be unaffected. The wall of the bowel remains pliant, peristalsis is not hindered,

and only rarely is a mass palpable in association. Ulceration, irregularity of contour of the polypoid lesion itself, evidence of induration or increased local rigidity of the wall of the colon at the site of the lesion, signify infiltration, hence malignancy. Thus it is apparent that the evidence for the presence of these lesions is largely roentgenoscopic. Roentgenography is successful only when conditions are favorable for approximation of the walls of the barium-filled bowel by compression. These considerations apply only to polypoid lesions which are large and which are accessible to manipulation at the time of roentgenoscopy. It is probable that polypoid lesions 2 cm. or less in diameter will almost always elude most careful roentgenoscopy, or will leave the examiner in an insecure state of mind regarding the reliability of his interpretation.

The opaque enema has not produced as reliable and accurate results in the demonstration of polypoid lesions of the colon as the opaque meal has yielded in the demonstration of similar lesions of the stomach. Before the "double contrast" method was available it seemed that the escape of many of these lesions, especially of the smaller ones, from roentgenologic detection, was inevitable. But the use of this roentgenologic procedure has made it possible, not only to detect many more lesions of this type than was previously possible and to project them roentgenographically, but also to complement less decisive roentgenoscopic data with the precise intraluminal picture which the method provides. Polypoid tumors occurring singly or those relatively sparsely distributed, are visualized as rounded, soft projections into the intestinal lumen. Their contours are outlined vividly in the air-distended bowel, and it is possible, when sufficient care has been exercised in carrying out the details of the technic, to determine the character of the surface contours of the growths (fig. 2). Properly applied, the method affords an estimate of the integrity of the interior of the colon attainable by no other method except direct visualization by the proctosigmoidoscope, or surgical or postmortem exploration. Be-

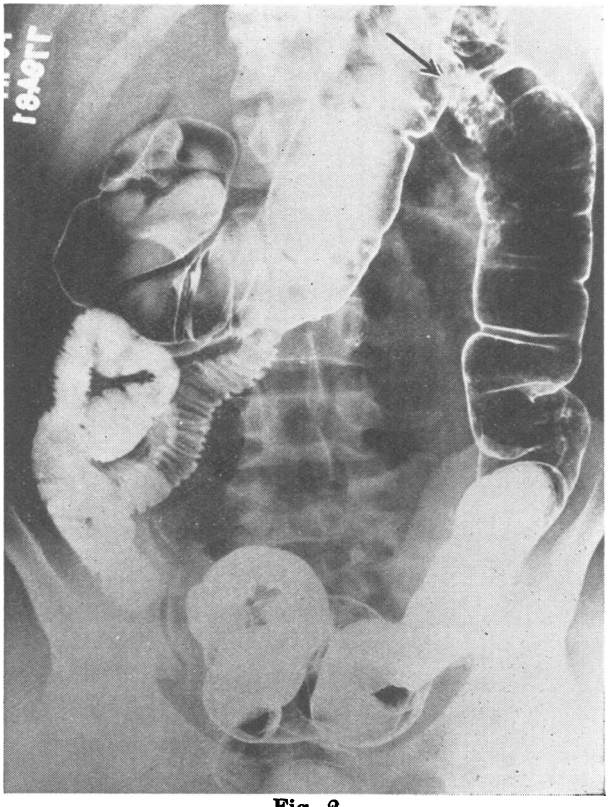

Fig. 2
Elongated polypoid tumor (note arrow) in the descending limb of the splenic flexure. This tumor had escaped roentgenoscopic detection because the involved segment was not accessible to permit approximation of the walls of the colon.

cause the combination of air and a thin coat of opaque material applied to the mucosal surface provides what is essentially a transparent medium, the method is profitably extended to present more clearly a lesion which may have been more or less adequately visualized roentgenoscopically, but which is obstinately obscured in the roentgenogram by overlying loops filled with the dense opaque contrast material of the barium enema.

Mature carcinoma.—Obviously most patients are sent for roentgenologic investigation of the colon when they

have presented a syndrome directly or indirectly referable to a lesion in the colon. When carcinoma is responsible even for vague symptoms it has developed morphologically to the extent that it is not only roentgenologically apparent as a lesion, but, with the exception of the polypoid lesions, its differential characteristics are manifest as well. This observation is based on experience with a considerable number of well-developed malignant lesions discovered roentgenologically in the course of routine examinations, when the expectancy for such discovery was very remote.

The filling defect is the essential roentgenologic sign which must be demonstrated before carcinoma can be diagnosed. The defect is defined as a subtraction from the normal outline of the colonic shadow, and may be central or marginal. It is produced chiefly by protrusion of the growth into the lumen of the bowel, and partly by diminished distensibility of the infiltrated wall. A certain amount of deformity is usually contributed by local spasm. The roentgenologic picture is in fact the shadow of a barium cast made with the lumen of the bowel as the matrix. Hence the filling defect produced by a given lesion will correspond with the luminal contours of the lesion. The extraluminal characteristics of the lesion are discernible only by inference from palpatory manipulation of the diseased area. It follows that the roentgenologic manifestations of carcinoma will vary within certain limits, depending on the morphologic character of the lesion encountered.

The filling defect of the scirrhous or fibrous carcinoma is short, and concentric. Its annular character is its most prominent feature. Ulceration is practically never demonstrable, and fixation to adjacent organs is rare, so that the lesion is uncommonly mobile. The tumor itself is usually so small that it is not palpable. The mass clinically so frequently associated with this type of lesion usually cannot be discovered at the roentgenologic examination if the preliminary preparation has been carried out faithfully. As in all instances of carcinoma, but particularly in this type of lesion, the demonstration of the filling defect is conditioned on the degree of patency of the involved

segment. When the constriction is pervious to the enema, and obstruction of sufficiently high degree exists, dilatation of the intestine proximal to the lesion is apparent (fig. 3). With these small annular lesions complete ob-

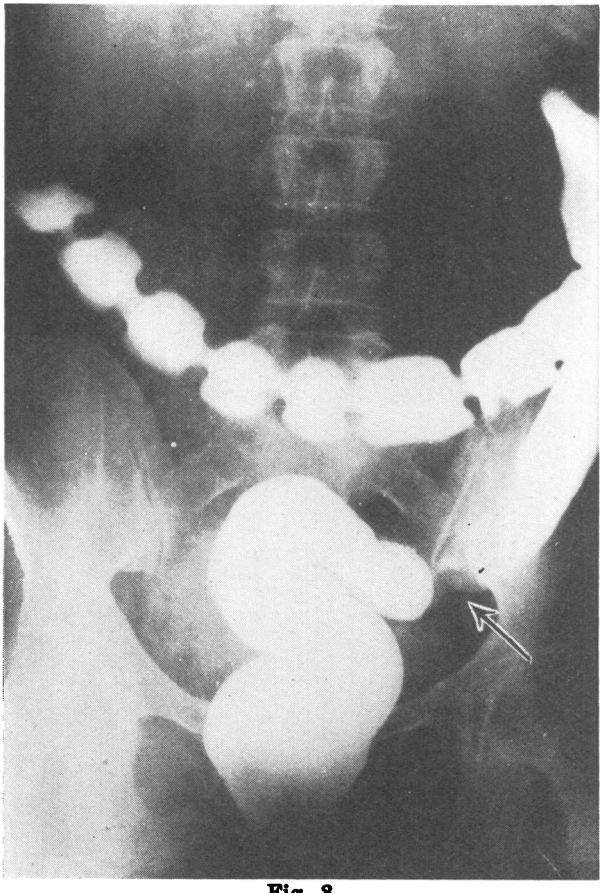

Fig. 3
Small annular carcinoma (note arrow) involving the upper portion of the sigmoid.

struction to the enema is most frequently encountered, and the canal of the filling defect is not visualized. In most cases, however, the constriction has permitted the fecal current to pass in the physiologic direction. Retrograde obstruction is caused either by a high-grade diminution

in caliber of the affected segment, or by the establishment of a valve mechanism in which lateral pressure is applied to the constricted area as the medium accumulates under force in the normally distensible bowel immediately adjacent to the lesion. In the former instance the barium column terminates in a conical, usually smooth, although sometimes ragged, projection (fig. 4); in the latter, it terminates in two convex smooth eminences on each side of the central constriction.

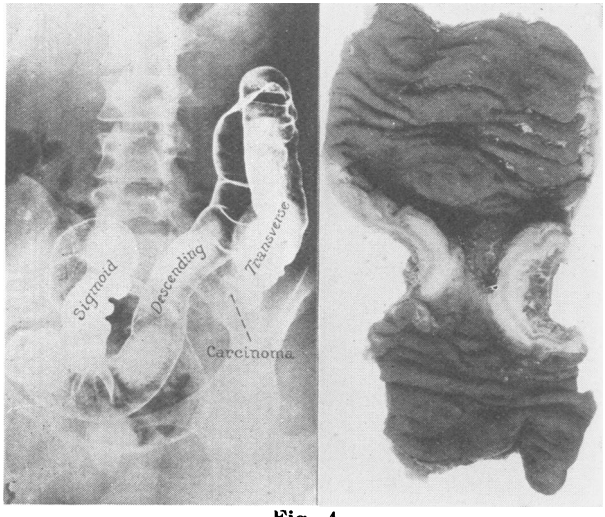

Fig. 4
Annular carcinoma in the transverse limb of the splenic flexure. This lesion produced complete obstruction to the enema and was not pervious to insufflation.

The appearance of the polypoid type of carcinoma varies within wider limits, depending on the size of the growth, the extent of ulceration, and the amount of mural infiltration. Deformity of the luminal contour is not the most striking feature of these lesions. More characteristic is the presence of lobulated, cauliflower-like masses projecting into the lumen (fig. 5). Displacement of the opaque material from their surfaces by approximating the walls of the affected segment with manual pressure presents the characteristic picture. Ulceration is revealed by the mass of opaque medium adhering to the ulcerated floor of the crater which is

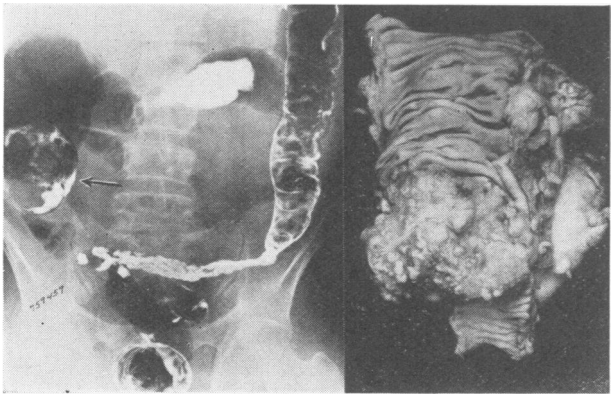

Fig. 5

Polypoid lesion (note arrow) involving the ileocecal juncture. Microscopic examination of the resected specimen showed the lesion to be an adenocarcinoma.

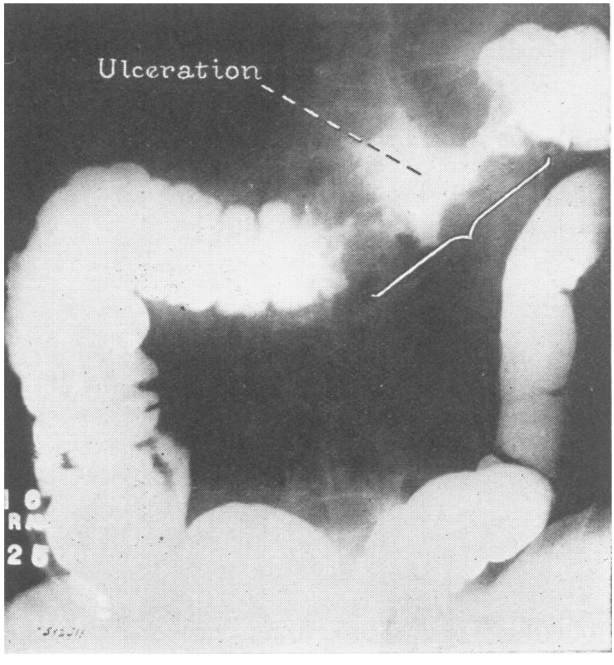

Fig. 6

Extensive ulcerating carcinoma in the transverse colon near the splenic flexure.

usually deep and bounded by irregular, overhanging margins (fig. 6). In the cecum and ascending segments of the colon, the polypoid lesion commonly involves only a portion of the circumference; in the narrower, more distal segments, however, the entire circumference is usually included.

The filling defect produced by the third type of carcinoma of the colon is again quite uniform in appearance. The tumor protruding into the lumen of the bowel produces a constriction which is longer in extent than that produced by the annular scirrhous type. The luminal aspect of the tumor is denuded and rough, which is reflected roentgenologically by markedly irregular and jagged contours and the tortuous course of the channel (fig. 7). The demarcation between normal and pathologic tissue is very abrupt, hence the termini of the filling defect have sharp contours, and tend to have a barbed or gnarled appearance. The tumor itself is usually large enough to be palpable through the abdominal wall, and the mass has the indurated knotty consistence associated with malignant tumors. Fixation may be present or absent. Complete or incomplete retrograde obstruction sometimes takes place, usually by the establishment of a valvular mechanism similar to that

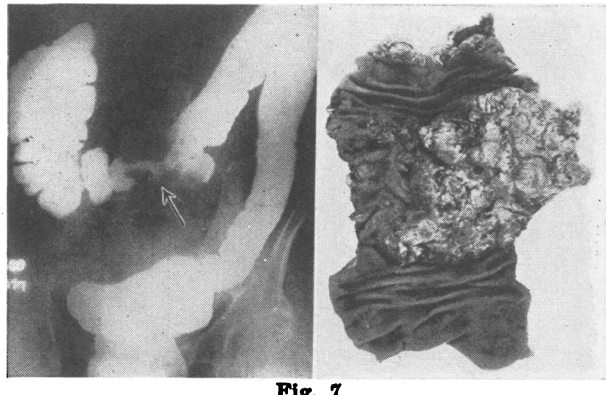

Fig. 7
Carcinoma (note arrow) involving the middle segment of the transverse colon. Attention is called to the irregular, jagged contours of the channel and to the abrupt demarcation between normal and pathologic tissue. The specimen was removed at operation.

formed with the short annular lesions. The roentgenologic appearance differs, however, in that the distal terminus of the process is represented as two symmetrically placed sharp prongs to each side of the channel through the tumor.

Differential Diagnosis

When irregularity in the outline of the colon distended with contrast material is encountered, the first problem is to determine whether the defect observed is real or apparent. Spasm is the one factor which is operative in producing distortion in the contour of the colon which is not real, although the appearance may simulate closely that of a genuine intrinsic lesion. Spastic filling defects often show their true character by changing their form or situation. At times, however, they may persist unchanged for a considerable period. Manipulation of the involved segment sometimes effaces them; often they are absent at the second examination. The effective use of antispasmodic drugs, however, is the most satisfactory method of determining the amount of spasticity operative in producing a given deformity. Not infrequently gross deformities in the outline of the colon are produced by acute or fulminating inflammatory processes in adjacent or contiguous organs. This is due either to an extension of the inflammation to the serosal surface of bowel, or to reflex spasm. At times the spasm is so marked that the lumen of the bowel is closed completely. Such a filling defect is distinguished from one due to an intrinsic lesion by the notation that it usually involves a relatively long segment, that its outline changes its form during the examination, and that evidence of mucosal change is absent. Localized areas of spasm are also encountered which are apparently reflex from acute or subacute inflammatory lesions in abdominal organs distant from the area of spasm.

Other causes of apparent rather than real filling defects are local accumulations of gas, fluid and fecal matter in the colon. These can usually be displaced by palpation during the roentgenoscopic examination, and they do not have a constant outline. Irregularities in outline caused

by pressure from other organs such as the spleen and gallbladder, from extrinsic tumors and from adjacent bony parts are readily distinguished from true filling defects by determining their extrinsic situation during the roentgenoscopic examination.

Carcinoma is not the only intrinsic disease of the colon which is manifested by the filling defect. Other tumefactive processes which produce localized deformities in the outline of the colon are diverticulitis, specific and nonspecific granulomatous lesions and benign organic strictures.

Diverticulitis is encountered practically only in the segment of the sigmoid. The filling defect produced by this disease is the result both of spasm, which may be so marked as to produce complete occlusion of lumen, and of the encroachment of the pericolic inflammatory tissue on the lumen of the bowel. It is usually possible to visualize diverticula in the more proximal uninvolved segments as rounded, knob-like projections from the lumen of the colon. Differential diagnostic points are the concentric serrated contours of the affected segment contrasted with the sharply irregular and eccentric contours of carcinoma, the maintenance of flexibility in the former compared with the stark rigidity in the latter, and the long segment involved with diverticulitis as opposed to the relatively short segment which carcinoma usually occupies (fig. 8).

Hyperplastic tuberculosis, amebic granuloma, and the mycotic affections of the bowel, named in the order of frequency of occurrence, are grouped together under the general term "specific granulomas." They are much more readily distinguished from carcinoma than they are from each other and from nonspecific granulomatous lesions. They are preeminently diseases of the "cecocolon," although nonspecific granulomas and the mycotic lesions, and less frequently hyperplastic tuberculosis, are encountered in other segments, especially in the sigmoid. The principal differential characteristic which all of these lesions possess in common is the length of the segment which

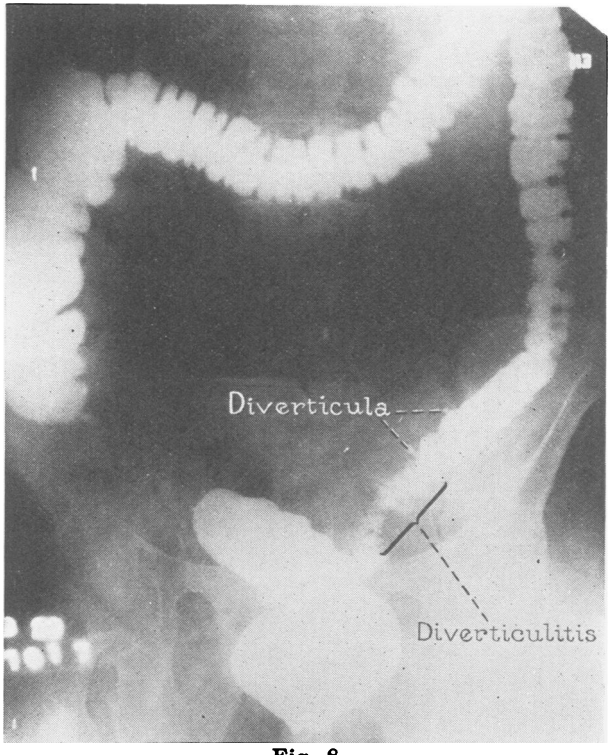

Fig. 8

Diverticulitis involving a long segment of the proximal sigmoid colon. The serrated contours and the presence of other diverticula in the more proximal segments may be seen.

they encompass in their involvement. The demarcation between the normal and the pathologic is gradual rather than abrupt, the channel of the filling defect is concentrically placed, tends to have a smooth outline, or if irregularities in contour are present, they are rounded and bulbous rather than jagged and angular. When a mass is palpable with these lesions it does not have the indurated consistence of malignancy, but is boggier and more dough-like. The lesions usually are fixed, but pliable.

Quite rarely chronic ulcerative colitis, specific or nonspecific, involves only a localized, short segment of the colon. An abrupt narrowing may be produced by such processes, and the moth-eaten appearance of the channel

makes the lesion bear a strong resemblance to carcinoma. The divergence of the therapeutic procedure which hinges on the diagnostic decision makes the differentiation highly significant. This type of lesion usually shows marked irritability; its channel is relatively broad, its margins smooth, and the lesion is pliable in spite of the marked localized mural thickening.

Organic stricture is exceedingly uncommon except as a complication of chronic ulcerative colitis. A short segment is usually involved, but the narrowing is spindle-shaped, the lesion is pliable, and has a smooth and regular outline (fig. 9).

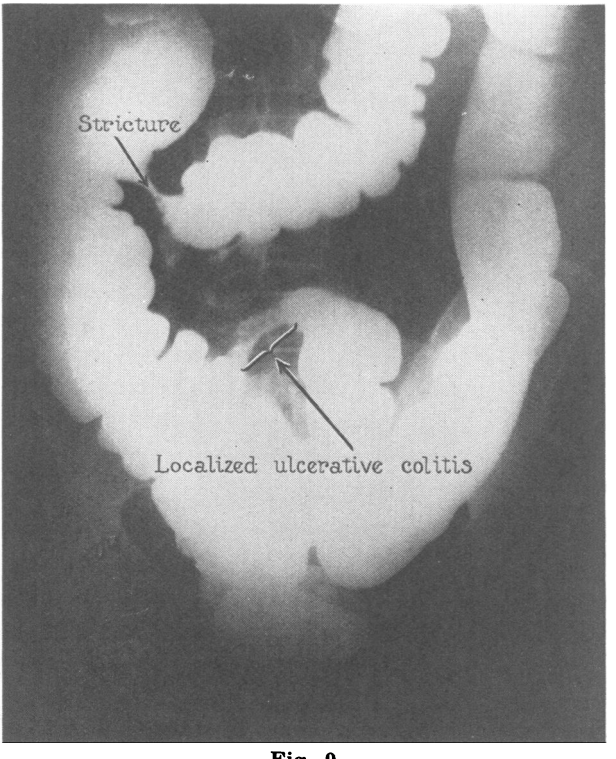

Fig. 9
Organic stricture in the transverse colon near the splenic flexure. The narrowing is spindle-shaped and the outline is smooth. The filling defect in the sigmoid was found at exploration to be an active area of chronic ulcerative colitis.

Occasionally tumefactions extrinsic to the colon produce constriction of its lumen by completely or incompletely encircling it. Pelvic tumors and masses of metastatic nodes in the abdomen have been responsible for such localized encroachments on the lumen of the colon in our experience. In spite of the marked constriction, evidence of obstruction was entirely absent in the cases of this type which we have examined. The defect, however, has none of the characteristics which we have learned to associate with malignancy.

The roentgenologic profession points with just pride to the contribution its special method of observation has made to the diagnosis of carcinoma of the stomach. Contribution to the diagnosis of carcinoma of the colon is equally gratifying, and equally important, for 10 per cent of all malignant lesions which occur in the gastro-intestinal tract occur in the large intestine or rectum. Success in the treatment of patients affected with carcinoma of the colon may be expected to advance hand in hand with the development of refinements in diagnostic methods. It is probable that a great many of the failures in treatment are attributable primarily to the late stage at which the lesion was recognized. Roentgenologic methods make it possible to recognize carcinoma in its early stages, often before there is adequate clinical evidence for suspecting its presence. The message is obvious. The disease must be recognized earlier to permit the earliest possible institution of proper therapeutic procedures. Any changes in intestinal habit, evidenced by irritability, mucous diarrhea, alternating periods of constipation, localized pain and tenderness which do not tend to disappear, not to mention tumefaction, anemia, and obstruction, all are indications for a most thorough-going roentgenologic investigation of the intestinal tract. It is not out of place to recommend that this investigation be included in the routine yearly examinations. Such measures are necessary to increase the operability of the malignant lesions encountered, and simultaneously will offer much more reasonable hope for satisfactory end results.

Bibliography

1. Berg, H. H. Röntgenuntersuchungen am Innenrelief des Verdauungskanals. Leipzig, Georg Thieme, 1930, 198 pp.
2. Doering, Hans: Die Polyposis intestini und ihre Beziehung zur carcinomatösen Degeneration. *Arch. f. klin. Chir.* 83:194-227, 1907.
3. Fischer, A. W.; Ueber eine neue röntgenologische Untersuchungsmethode des Dickdarms: Kombination von Kontrasteinlauf und Luftaufblähung. *Klin. Wchnschr.* 2:1595-1598 (Aug.) 1923.
4. FitzGibbon, Grattan and Rankin, F. W.; Polyps of the large intestine. *Surg., Gynec., and Obst.* 52:1136-1150 (June) 1931.
5. Forssell, Gösta: Studies of the mechanism of movement of the mucous membrane of the digestive tract. *Am. Jour. Roentgenol. and Radium Therap.* 10:87-104 (Feb.) 1923.
6. Knothe, Werner: Schleimhautstudien am normalen und kranken Dickdarm. *Ztschr. f. klin. Med.* 108:199-214, 1928.
7. Laurell, Hugo: Discussion. *Acta Radiol.* 1:491-492, 1922.
8. Rankin, F. W.; Surgery of the colon. New York, D. Appleton & Co., 1926, 366 pp.
9. Schmieden, Viktor: Der histogenetische Ursprung des Mastdarmkarzinoms aus den Mastdarmpolypen. *Deutsch. med. Wchnschr.* 2:1997-2000 (Nov.) 1929.
10. Schmieden, V., and Westhues, H.: Zur Klinik und Pathologie der Dickdarmpolypen und deren klinischen und pathologisch-anatomischen Beziehungen zum Dickdarmkarzinom. *Deutsch. Ztschr. f. Chir.* 202:1-124 (May) 1927.
11. Weber, H. M.: The roentgenologic demonstration of polypoid lesions and polyposis of the large intestine. *Am. Jour. Roentgenol. and Radium Therap.* 25:577-589 (May) 1931.